September 1975

SERVICES
U S D A FOREST SERVICE
RESEARCH NOTE RM-301

OCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

A Sturdy Probe for Measuring Deep Snowdrifts[1]

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Sections of hexagonal aluminum rod joined with pump couplings form a rigid probe that does not bend while penetrating ice layers. Bit design is important.
Keywords: Snow management, snowpack, snow measurement, snow-depth data.

Large snowdrifts in windswept terrain often are too dense, icy, or deep to measure with conventional coring equipment. When only snow-depth data are needed, the most convenient and fastest method of measuring snow is to probe the snowpack. A probing rod is commonly used to measure depths of deep snowdrifts. Our experience has shown, however, that probe design is a critical factor for accurate results. This Note describes a snow probe we have developed over a 10-year period to sample drifts as deep as 40 feet.

Description

The probe consists of sections of 9/16-inch hexagonal aluminum rod (alloy 2011-T3) coupled together with threaded steel stock and "pump-rod" couplings (fig. 1).

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Hexagonal aluminum rod is superior to other materials because it is rigid, light weight (4.25 pounds for a 12-foot section), and rust resistant, and the flat surfaces are ideal for marking scales. We found ½-inch rod to be too flexible for sampling deep, dense snowdrifts because of the tendency for the probe to bend on ice layers (fig. 2). A probe made of 5/8-inch rod works well on dense snowdrifts, but requires two men to push the probe down.

Proper design of the point (or "bit") is important (fig. 3). Bit diameter must be larger than the probe rod to reduce friction and to prevent the rod from freezing in the snowpack. The point, however, must not be so large as to resist penetration excessively. The bit must be sharp enough to penetrate dense snow or ice layers, but not so sharp as to make it difficult to detect contact with the ground.

Construction

Where portability is needed, the hexagonal bar can be cut into 6-foot sections (or shorter if necessary); but for hard, deep drifts it is best to maintain the bottom section as a one-piece 12-foot section. All upper sections should be in 6-foot lengths. The cut rod should be polished on a wire wheel to remove the

Figure 1.—Sections of a snow probe are connected with threaded steel stock and a pump rod connector.

Figure 2.—A flexible rod can be turned by hand.

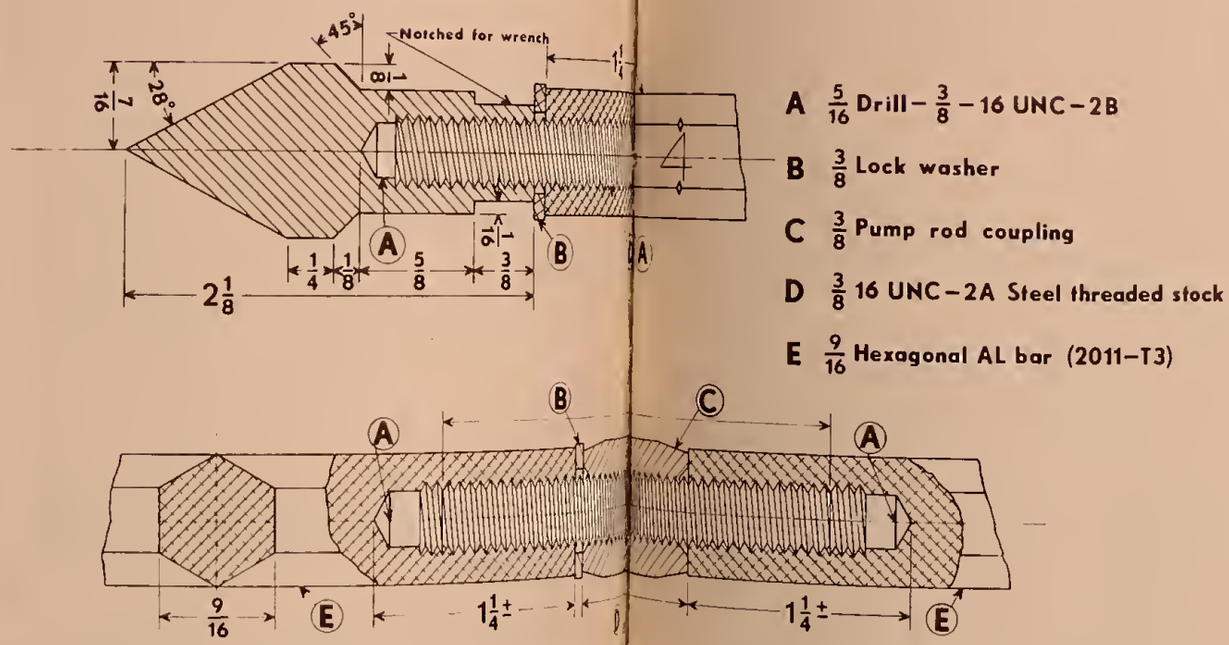

Figure 3.—Detail of a 9/16-inch snow

factory coating, which otherwise causes snow to stick to the probe. Holes 5/16 inch in diameter and 1¼ inch deep are drilled in both ends of each section, using a lathe to insure proper alinement. The holes then are tapped (threaded) with a 3/8-inch bottoming tap.

A 3½-inch length of threaded steel stock is then screwed into one end of each section. Next, a 3/8-inch pump-rod coupling (with a 3/8-inch lock washer) is screwed onto the steel stock and tightened in place with a wrench.

The bit (fig. 3) is machined on a metal lathe. It is made from 7/8-inch cold-rolled steel rod. The probe end of the bit has the same diameter as the probe (5/8 inch) and is 1 inch long. A 5/16-inch diameter, 1-inch deep hole is drilled into the probe end and tapped (threaded) with a 3/8-inch bottoming tap to attach the bit to the probe rod. An expanded diameter collar (7/8 inch in diameter and ¼ inch long) is machined on the pointed end of the bit. The angle from the collar to the tip is 28 degrees.

After the probe is assembled, depth scale divisions are measured off, scribed with a file, and stamped with numbers. Artists' oil-base paint rubbed into the numbers makes them more visible.

Materials for a 9/16-inch snow probe 24 feet long and their approximate 1974 purchase cost are listed below:

Part	Quantity	Amount
9/16-inch hexagonal aluminum bar (Alloy 2011-T3)	24 feet	$15.76
3/8-inch threaded stock	10½ inches	.69
3/8-inch pump rod coupling	2 each	1.14
3/8-inch lock washer	3 each	.09
7/8-inch cold-rolled steel rod	4 inches	.20
Total		$17.88

Field Techniques

With two men pushing the probe down in strong thrusts, we have measured depths up to 40 feet in snow with a 50 percent water equivalent. When probing drifts deeper than 12 feet, single 6-foot sections are added successively as the probe is pushed into the pack. These sections of rod should be removed as they are pulled from the pack to prevent bending the rod.

The design of this probe minimizes rod freezing, but occasionally snowpack conditions and air temperatures combine to make this situation unavoidable. In this event, the probe can be freed by either twisting the rod (clockwise) with a wrench, or by tapping the top of the probe with a wooden mallet, quickly followed by an upward pull on the probe.

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